

NEOTROPICAL TINEIDAE, VI: *PROSETOMORPHA FALCATA*, A NEW  
GENUS AND SPECIES OF SETOMORPHINAE (LEPIDOPTERA: TINEOIDEA)  
FROM COLOMBIA ASSOCIATED WITH CURCULIONID GALLERIES IN  
STEMS OF *SOLANUM*

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*Abstract.*—Adult and immature stages of *Prosetomorpha falcata*, a new genus and species of tineid moth from Colombia, are described and illustrated. *Prosetomorpha* is remarkable in being the most plesiomorphic setomorphine tineid discovered, as evidenced by the five-segmented maxillary palpi, moderately well developed haustellum, mandibles vestigial but distinct, female with signum present, and larva with six pairs of stemmata. Synapomorphies shared with other Setomorphinae include similar semi-appressed head vestiture, annulate but completely fused, eighth abdominal tergosternum in the male, membranous eighth abdominal segment without rami in the female, and larvae with unidentate mandibles. The larva is believed to be primarily a scavenger within the burrows of a curculionid weevil, *Faustinus apicalis* (Faust), that bores in the stems of *Solanum quitoensis* var. *quitoensis* Lamarck and *S. quitoensis* var. *septentrionale* R. E. Schultes. A braconid parasitoid, *Promicrogaster* sp., has been reared from burrows occupied by *Prosetomorpha*.

*Key Words:* Tineidae, Setomorphinae, *Prosetomorpha*, immatures, scavenger, host record, *Solanum*, Curculionidae, *Faustinus*, Neotropical

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In the course of their investigations on the insect pests of *Solanum quitoensis* Lamarck, known locally as “lulo” or “naranjillo,” entomologists at the Instituto Colombiano Agropecuario (ICA) of Bogotá, Colombia, have reared a previously unknown, stem-boring setomorphine moth, *Prosetomorpha falcata*. The larva was found frequently in association with larvae of the stem-boring weevil, *Faustinus apicalis* (Faust). Considering what is known of the larval biology of other Setomorphinae (Hinton 1956, Gozmány and Vari 1973, Zimmerman 1978, Robinson and Nielsen 1993), the new species probably feeds primarily as a scavenger within the tunnels of the weevil. Observations indicate, however, that living plant tissue is also consumed.

Morphological comparisons of the larva, pupa, and adult reveal that *Prosetomorpha* is a member of the Setomorphinae, a small, mostly neotropical subfamily, previously represented by two genera (*Setomorpha*, *Lindera*) and approximately eight species (Robinson and Nielsen 1993). *Prosetomorpha* is of phylogenetic interest in being the most plesiomorphic member of the subfamily, as evidenced by the five-segmented maxillary palpi (Figs. 13, 14), relatively well developed haustellum, mandibular vestiges distinct, female with signum present (Figs. 24, 25), and larva with six pairs of stemmata (Figs. 35, 55). The discovery of *Prosetomorpha* consequently broadens our definition of the subfamily, which previ-

ously had been characterized in part by moths with more reduced mouthparts and by larvae lacking stemmata (Hinton 1956, Zimmerman 1978, Robinson and Nielsen 1993). Synapomorphies shared with other Setomorphae include similar semi-appressed head vestiture (Figs. 3, 4), slender annulate eighth abdominal sclerite with stout projections directed anteriorly in the male (Fig. 19), membranous eighth abdominal segment without rami in the female (Fig. 24), and larva with unidentate mandibles (Fig. 56). In addition to retaining the plesiomorphies listed above, *Prosetomorpha* differs most notably from *Lindera* and *Setomorpha* by the presence of 1 and  $\frac{1}{2}$  annuli of flagellar scales (a basal, dorsally abbreviated row and an entire distal annulus (Figs. 5, 6), falcate forewings, and a completely fused, eighth abdominal tergosternal ring in the male. In other Setomorphae the adults possess a single annulus of flagellar scales, the forewings terminate in a simple rounded apex, and the eighth abdominal sclerite of the male is interrupted dorsally.

### *Prosetomorpha* Davis, NEW GENUS

Type species.—*Prosetomorpha falcata*, new species.

Adult.—Moderately large moths with falcate forewings; length of forewing = 8.5–13 mm.

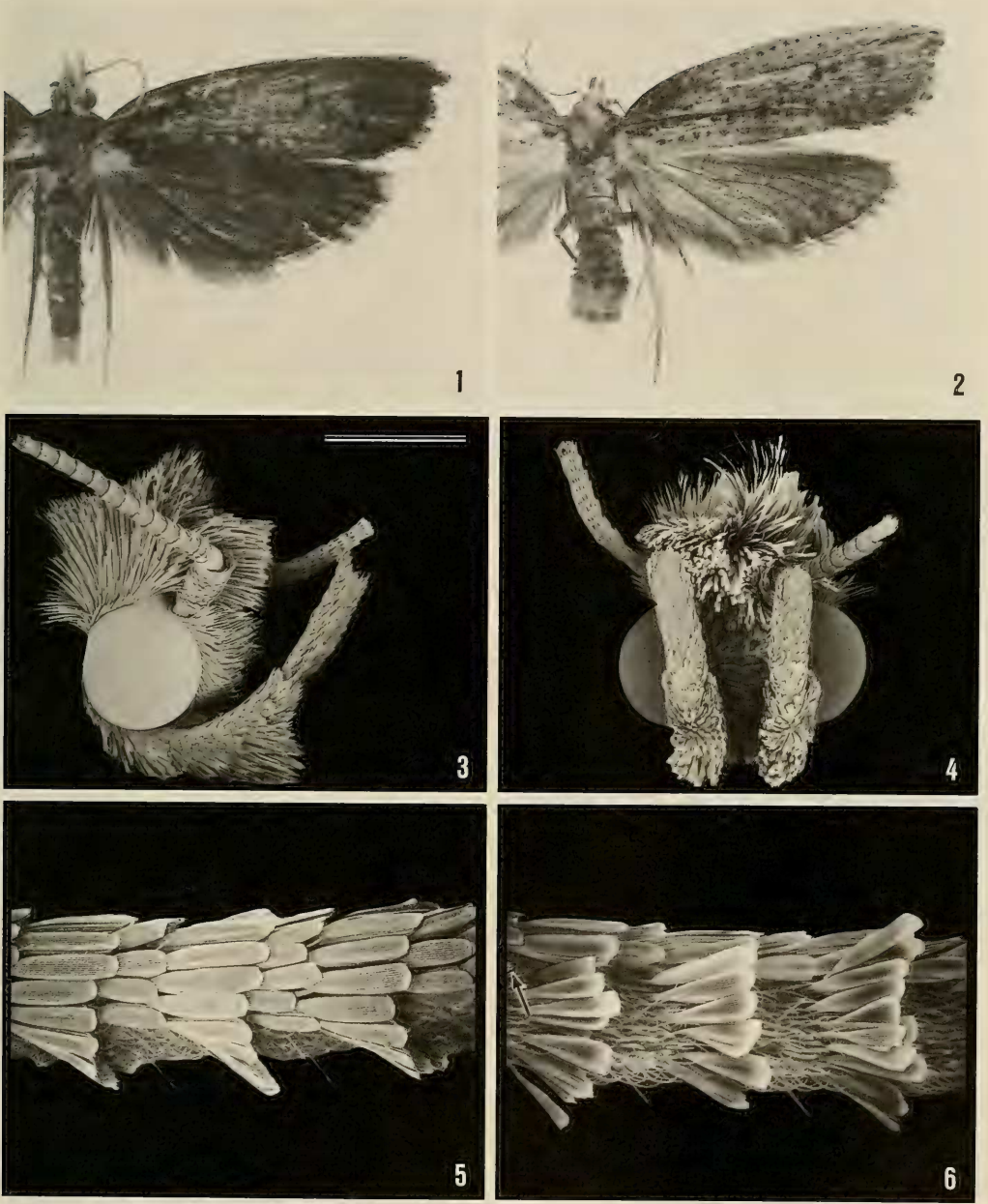
*Head* (Figs. 3, 4, 13, 14): Vertex moderately rough with lateral tufts converging mesally over occiput and projecting anteriorly between antennae over frons; scales slender with bidentate apices. Frons relatively smooth, scales directed mesally. Antenna simple in both sexes; length ca.  $\frac{1}{3}$  of forewing; scape cylindrical, without pecten; flagellum (Figs. 5, 6) with two rows of slender scales per segment dorsally, with only the distal row forming a complete ring. Pilifers well developed, densely setose. Mandibles (Fig. 13) present but vestigial, equalling apical segment of maxillary palpus in length. Haustellum moderately developed (Fig. 14), slightly exceeding length

of maxillary palpus. Maxillary palpus 5-segmented, with ratios from base = 0.2: 0.18: 0.18: 1: 0.33. Labial palpus 3-segmented; ratios from base = 0.43: 1: 0.88; segment II smooth dorsally and laterally, with rough, triangular tuft ventrally; bristles absent; segment III entirely smooth, depressed.

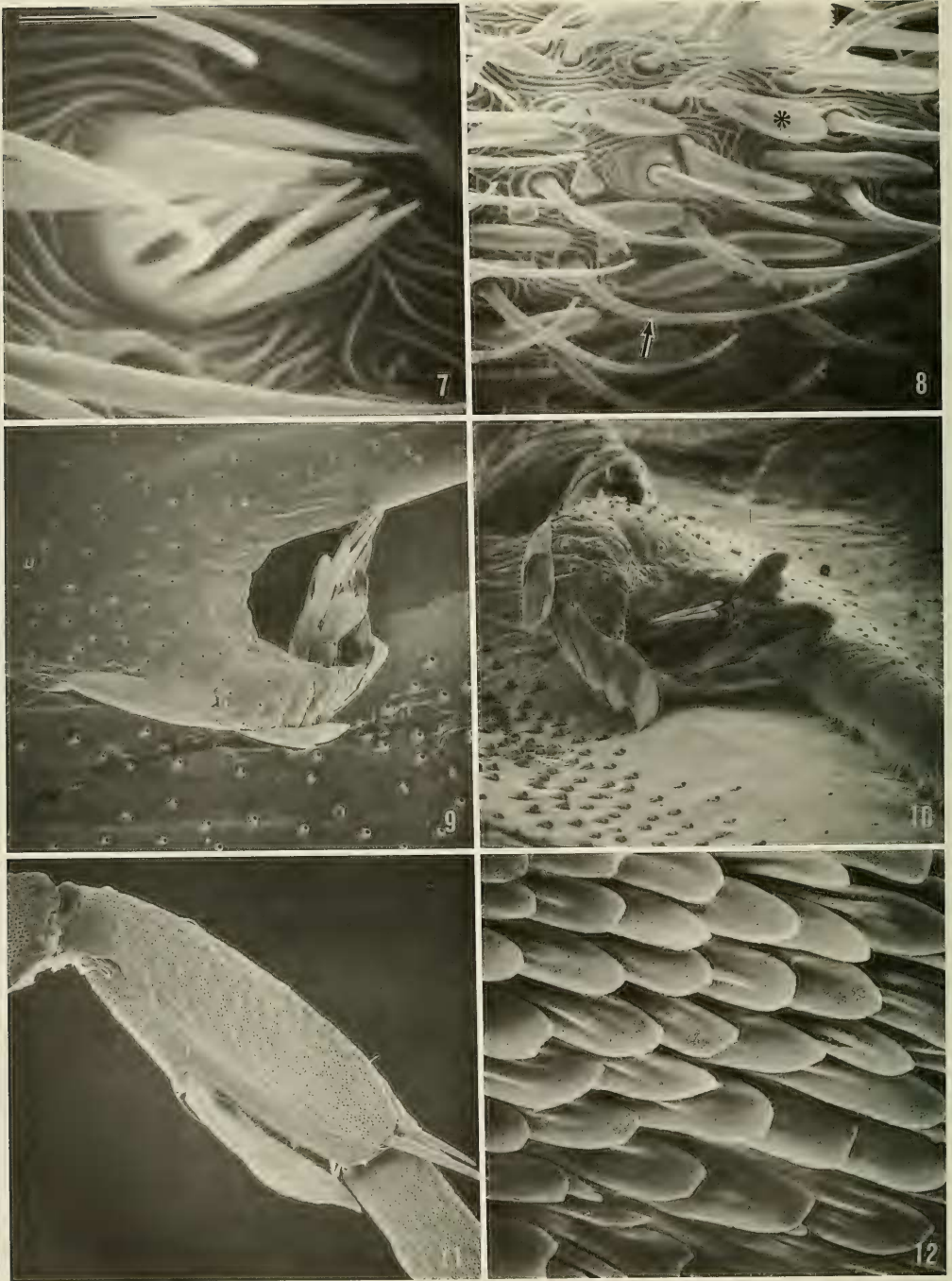
*Thorax*: Metafurcasternum (Figs. 16, 17) with anteromedial process (APM) elongate, slender, with a pair of furcal apophyses (FA) directed sharply anteriorly; furcal ridge continues caudally and terminates as a pair of rounded lobes arising inside lamina of secondary furcal arms (LSF). Forewing (Fig. 15) falcate, abruptly indented between apex and M1; R 5-branched; R4 and 5 stalked half their length; R5 terminating before apex; all 3 branches of M separate; CuA1 and 2 arising approximate; A1 and 2 fused except for fork at basal third; accessory cell present; base of media usually not evident within discal cell; retinaculum of male a tightly curled flap (Figs. 9, 10). Hindwing with all veins arising separate; M 3-branched; base of media divided within cell; male with a single stout frenulum; female with 2 smaller frenular bristles. Foreleg (Fig. 11, 12, 18) with epiphysis ca. 0.5 the length of shortened tibia, the latter equal in length to tarsomere I. Tibial spurs = 0–2–4. Apices of all tibiae and tarsomeres with 3 stout, spiniform setae (Fig. 11).

*Abdomen* (Fig. 19): Sternal apophyses slender, ca. half the length of S2. Eighth segment of male with a slender, sclerotized ring completely encircling segment; a pair of slender projections arising laterally from ring; T7 reduced, triangular. A pair of non-retractible coremata arising ventrally from S8 of male. Corethrogynae of female consisting of a dense ring of elongate, straight setae.

*Male genitalia*: Tegumen reduced to a narrow dorsal ring. Vinculum similar to and continuous with tegumen as a narrow ventral ring; saccus short, ca. 0.14 the length of valva, compressed. Valva long, ca. 1.3× the



Figs. 1-6. *Prosetomorpha falcata*. 1, Adult male, forewing length 10.6 mm. 2, Female, forewing length 14 mm. 3, Head, lateral view (0.75 mm). 4, Anterior view of Fig. 3. 5, Lateral view of antenna at distal third showing two dorsal rows of scales (annuli; 100  $\mu$ m). 6, Ventral view of Fig. 5 showing continuation of distal row of scales and position of sensilla coeloconicum (see arrow; 100  $\mu$ m). (Scale lengths in parentheses; bar scale for all photographs = Fig. 3.)



Figs. 7-12. *Prosetomorpha falcata*, adult. 7, Sensilla coeloconicum shown in Fig. 6 ( $5\ \mu\text{m}$ ). 8, Ventral sensilla of antenna showing details of sensilla chaetica (arrow) and sensilla auricillica (asterisk) ( $15\ \mu\text{m}$ ). 9, Male retinaculum, ventral view, ( $120\ \mu\text{m}$ ). 10, Distal view of Fig. 9 ( $100\ \mu\text{m}$ ). 11, Foretibia with epiphysis and apical spines ( $176\ \mu\text{m}$ ). 12, Detail of epiphysis showing flat spines (comb;  $6\ \mu\text{m}$ ). (Scale lengths in parentheses; bar scale for all photographs = Fig. 7.)

length of genital capsule; sacculus moderately broad, gradually narrowing to extremely slender cucullus (Fig. 22), bearing a small recurved spine at apex. Juxta a flat, subrectangular, elongate plate, with length ca.  $2\times$  width. Aedoeagus a relatively simple, slightly depressed, elongate, and slightly curved (viewed laterally) tube; cornuti absent.

*Female genitalia:* Ovipositor elongate, telescoping. Posterior apophyses  $1.7\times$  the length of anterior pair. Ventral pseudapophyses absent. Ostium bursae indistinct, broad; a small, sclerotized, triangular sclerite (lamella postvaginalis; Fig. 24, LP) immediately caudad to ostium; lamella postvaginalis with a slender keel-like process extending anteriorly; ductus bursae mostly broad, membranous except for a dense, elongate patch of minute spinules from anterior end that extends to signum within corpus bursae; corpus bursae moderately enlarged (Fig. 24), with a single densely spinose signum (Fig. 25).

*Etymology.*—The generic name is derived from the Greek prefix *pro* (before) combined with the generic name *Setomorpha*. It is considered feminine in gender.

### *Prosetomorpha falcata* Davis, NEW SPECIES

Male (Fig. 1).—Length of forewing 8.5–10.1 mm. *Head* (Figs. 3, 4, 13, 14): Vertex buff to dark brown; frons paler, cream to buff. Antenna with scape mostly fuscous, paler ventrally; flagellum light brown, covered with narrow scales dorsally, mostly naked ventrally except for dense pubescence of short sensilla chaetica and dense, slender sensilla auricillica (Fig. 8). Maxillary palpus cream to white. Labial palpus mostly cream to white with external sides of I and II irrorated with fuscous. *Thorax:* Dorsum brown, irrorated with fuscous; tegulae mostly fuscous. Venter pale buff to cream. Forewing variably light to dark brown, finely spotted with small clusters of dark fuscous scales, fringe similarly mottled with

light to dark brown scales with suffusion of cream around tornus. Hindwing uniformly fuscous except for streak of white along costa, broadest at wing base and narrowing toward apex; fringe generally lighter in color, gray along hind margin becoming more white toward apex with streaks of fuscous. Legs mostly dark fuscous dorsally, pale buff ventrally, with buff banding on tibia and more faint at apices of tibia and tarsomeres. Hindleg much paler, lighter brown. *Abdomen:* Dark fuscous dorsally and laterally, cream ventrally with long, cream, piliform scales over A8 largely covering genitalia.

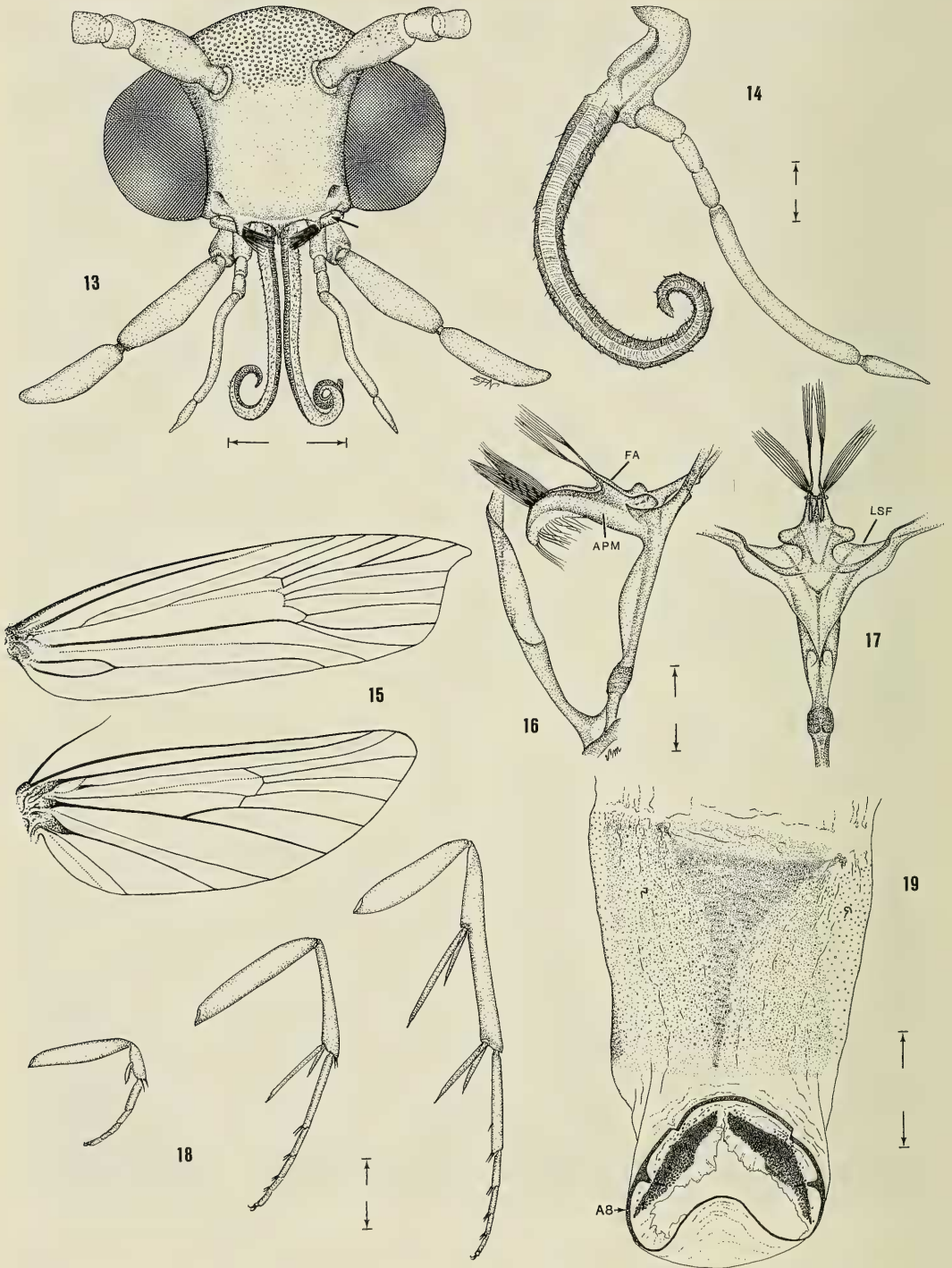
Female (Fig. 2).—Length of forewing 10.5–13.0 mm. Generally paler than male. *Head:* Light brown to white with light brown scaling laterally on labial palpus. Forewing light brown with fuscous spots more evident. Hindwing gray with whitish costal streak as in male. Legs with similar markings to male but generally lighter in color.

Male genitalia (Figs. 20–23).—As described for genus.

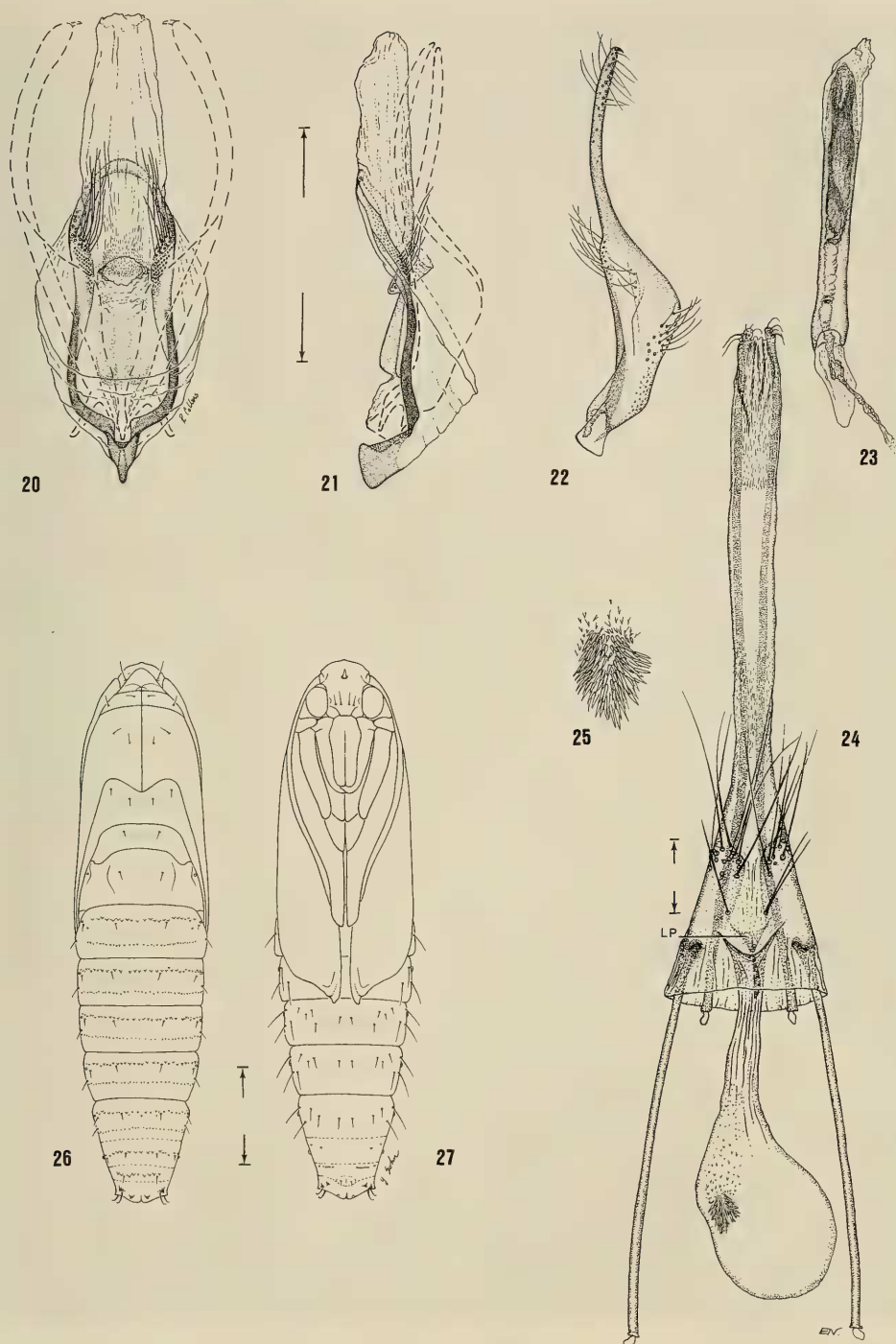
Female genitalia (Figs. 24, 25).—As described for genus.

Larva (Figs. 30–42, 49–58).—Length of largest larva 20 mm, maximum diameter 2.9 mm. Body generally white with distinct dark brown plates and pinacula (Figs. 49, 50).

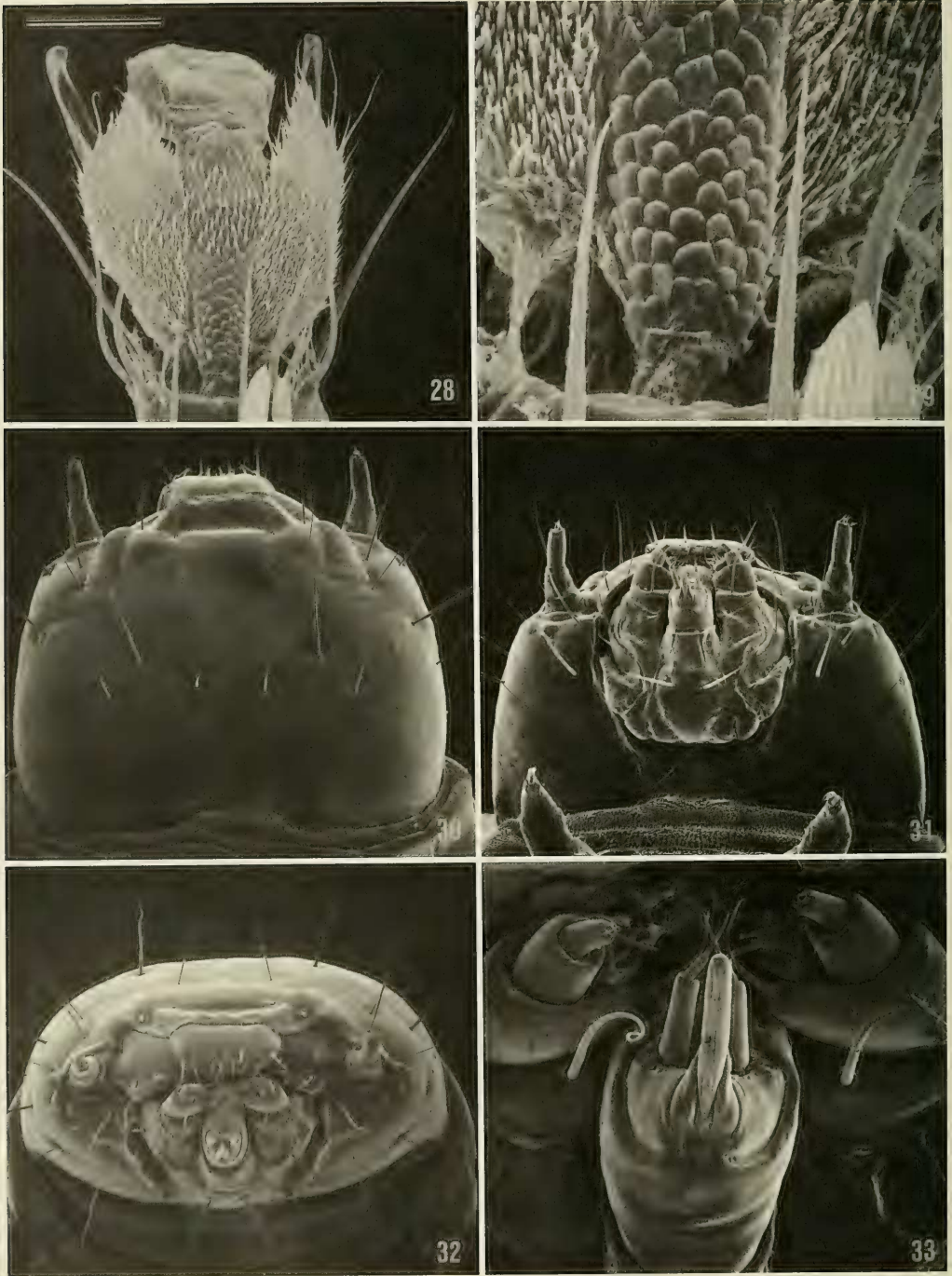
*Head:* Maximum width 2.7 mm. Color reddish brown, becoming darker over frons and along anterior margins. Chaetotaxy as illustrated (Figs. 30–32, 34, 52, 53, 55); AF 1 absent. Stemmata (Figs. 35, 55) consisting of 6 pairs, with 3–5 contiguous near lateral rim of antennal socket, and 6 more remote and ventral. Mandible unidentate (Fig. 56). Spinneret (Fig. 33) slender and elongate with a minute orifice. Labial palpus 2-segmented, slender and elongate, ca. 0.8 the length of spinneret; apical segment less than  $\frac{1}{3}$  the length of basal segment; apical seta  $1.5\times$  the length of second segment. Apex of mentum with a pair of minute secondary labial setae (Fig. 33).



Figs. 13–19. *Prosetomorpha falcata*, adult. 13, Head, anterior view; mandible (see arrow; 0.5 mm). 14, Detail of maxilla (0.2 mm). 15, Wing venation. 16, Metafurcasternum, lateral view (0.5 mm). 17, Caudal view of Fig. 16. 18, Leg structure (1 mm). 19, Ventral view of male abdominal segments 7–8; note complete, sclerotized ring on A8 (0.5 mm). (Scale lengths in parentheses.)



Figs. 20–27. *Prosetomorpha falcata*, adult. 20, Male genitalia, ventral view (0.5 mm). 21, Lateral view. 22, Mesal view of valva. 23, Ventral view of aedeagus. 24, Female genitalia, ventral view; LP = lamella postvaginalis (0.5 mm). 25, Enlarged detail of signum shown in Fig. 24. 26, Pupa, dorsal view (2 mm). 27, Ventral view. (Scale lengths in parentheses.)



Figs. 28–33. *Prosetomorpha falcata*. 28–29, Adult: 28, Pretarsus of hindleg, ventral view (38  $\mu$ m). 29, Detail of unguitactor plate in Fig. 28 (12  $\mu$ m). 30–33, Last instar larva: 30, Head, dorsal view (0.43 mm). 31, Head, ventral view (0.43 mm). 32, Head, anterior view (0.43 mm). 33, ventral view of maxilla and labium (100  $\mu$ m). (Scale lengths in parentheses; bar scale for all photographs = Fig. 28.)



*Thorax:* Pronotum and spiracular plates dark reddish brown. Lateral setae trisetose and together with spiracle on same plate; a crescent shaped, hyaline separation immediately anterior to spiracle (Fig. 51). Meso- and metathorax with L3 arising on separate pinacula from L1–2. MSD1 and 2 reduced, of similar lengths. Legs well developed; tarsal claw moderately stout, with an abruptly enlarged base (Fig. 38). Coxae widely separated, bearing 6 setae.

*Abdomen:* L1–3 on separate pinacula on segments A1–8; L2 and 3 together on A9. SV trisetose on A1–8, with SV1 and 3 together on same pinacula on A1–6. Anal plate with 5 pairs of setae, including extra seta XD1 (Fig. 51). Prolegs well developed on A3–6 and 10; crochets A3–6 uniordinal, uniserial, and arranged in a complete ellipse of approximately 45–47 hooks; a scattered band of smaller, numerous spines encircling apex of planta (Fig. 39); crochets on A10 consisting of a single row of approximately 20–22 hooks along anterior edge of planta (Fig. 42).

Pupa (Figs. 26, 27, 43–45, 59–64).—Length 9–11.3 mm; width 2.9–3.3 mm. Color usually light reddish brown, becoming darker anteriorly. Head smooth except for a minute, subapical, slightly curved spine projecting anteriorly and appressed to head (Fig. 45); length of spine ca. 90  $\mu$ m long. Labrum with a pair of lateral setae (Fig. 59). Forewings extending beyond caudal margin of A4 (Fig. 27). Hindlegs only to middle of A3. A3–7 with a small anterior row of spines and a smaller, caudal row of spines; tabulation of spines as follow: A3, anterior = 26–29, posterior = 51–58; A4 (Fig. 60), anterior = 43–47, posterior = 67–75; A5, anterior = 50–60, posterior = 70–77; A6, anterior = 42–49, posterior = 63–71; A7, anterior = 34–38, posterior = 24–28; A8 = 17–19; A9 = 9–10. A10 encircled by 8 stout spines of equal size (Figs. 61–64) as follow: a dorsal pair, 2 lateral pairs bearing short setae, and a ventral pair separated further apart than dorsal pair.

Holotype.—♂; COLOMBIA: Anolaima,

1560 m, Cundinamarca Prov.; Oct 1988, I. Zenner, ex stem of *Solanum quitoensis* [var. *septentrionalis* R. E. Schultes], USNM.

Paratypes.—Same data as holotype: 6 ♂, 9 ♀, 11 cocoons, slides USNM 30429, 30430, 30597, 30598, 31566, 31573, (BMNH, ICAB, USNM); Same locality as holotype: 2 ♂, 2 ♀, May 1990, I. Zenner, ex stem of *Solanum quitoensis* [var. *quitoensis* Lamarck, (ICAB, USNM)]; 13 larvae, slides USNM 30599, 30600, 30677, 8 pupae, slides USNM 30602, 30603, 31605, May 1988, ex stems of *Solanum quitoensis* [var. *septentrionalis* R. E. Schultes, (USNM)].

Hosts.—Solanaceae: *Solanum quitoensis*; Zenner-Polanía (in corres. 6 Jun 1990) reports both the spiny variety *septentrionalis* R. E. Schultes and the smooth variety *quitoensis* Lamarck as hosts.

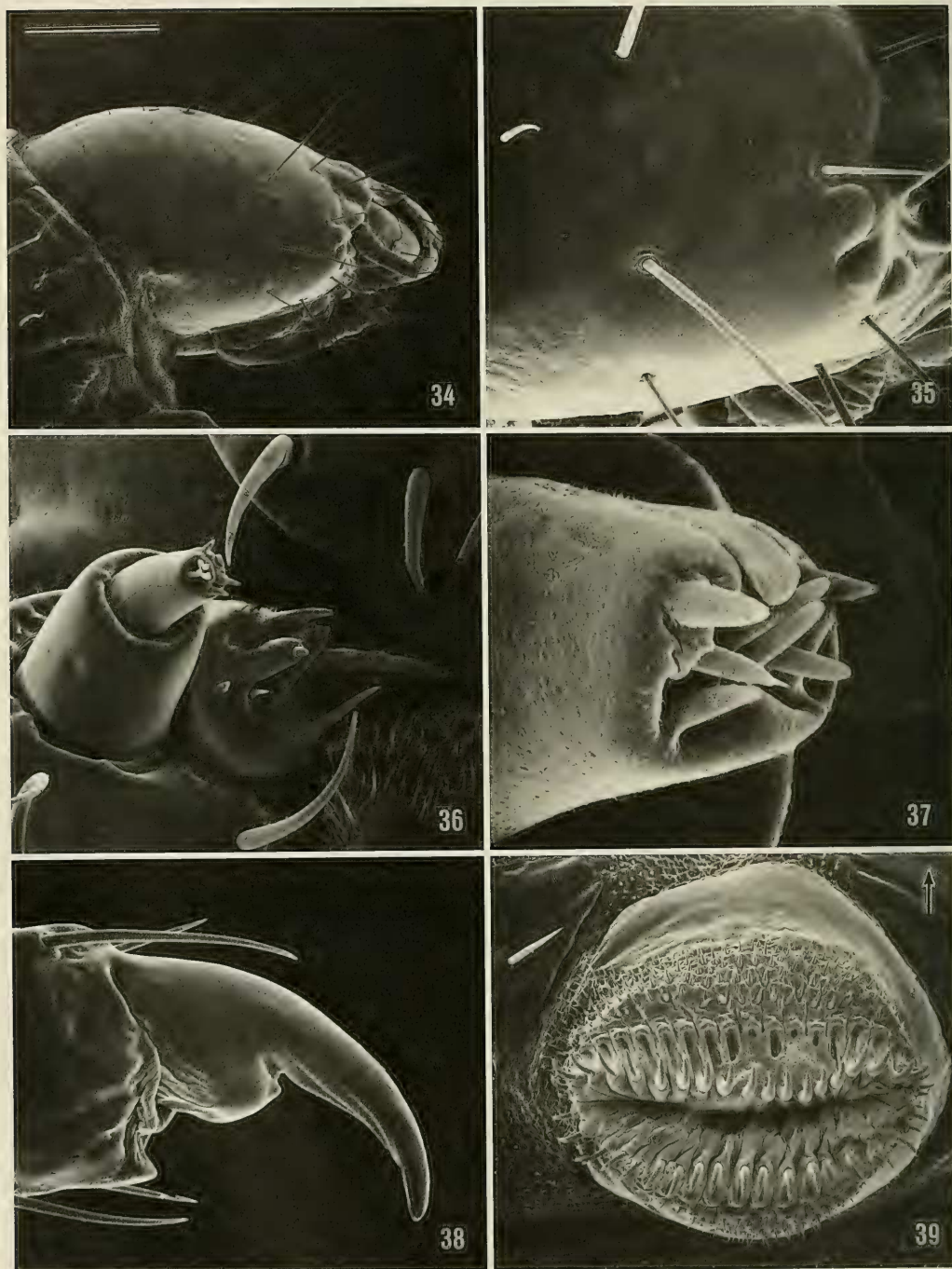
Parasitoid.—Braconidae: *Promicrogaster* sp. (det. P. M. Marsh).

Distribution.—Reported only from the type locality in central Colombia.

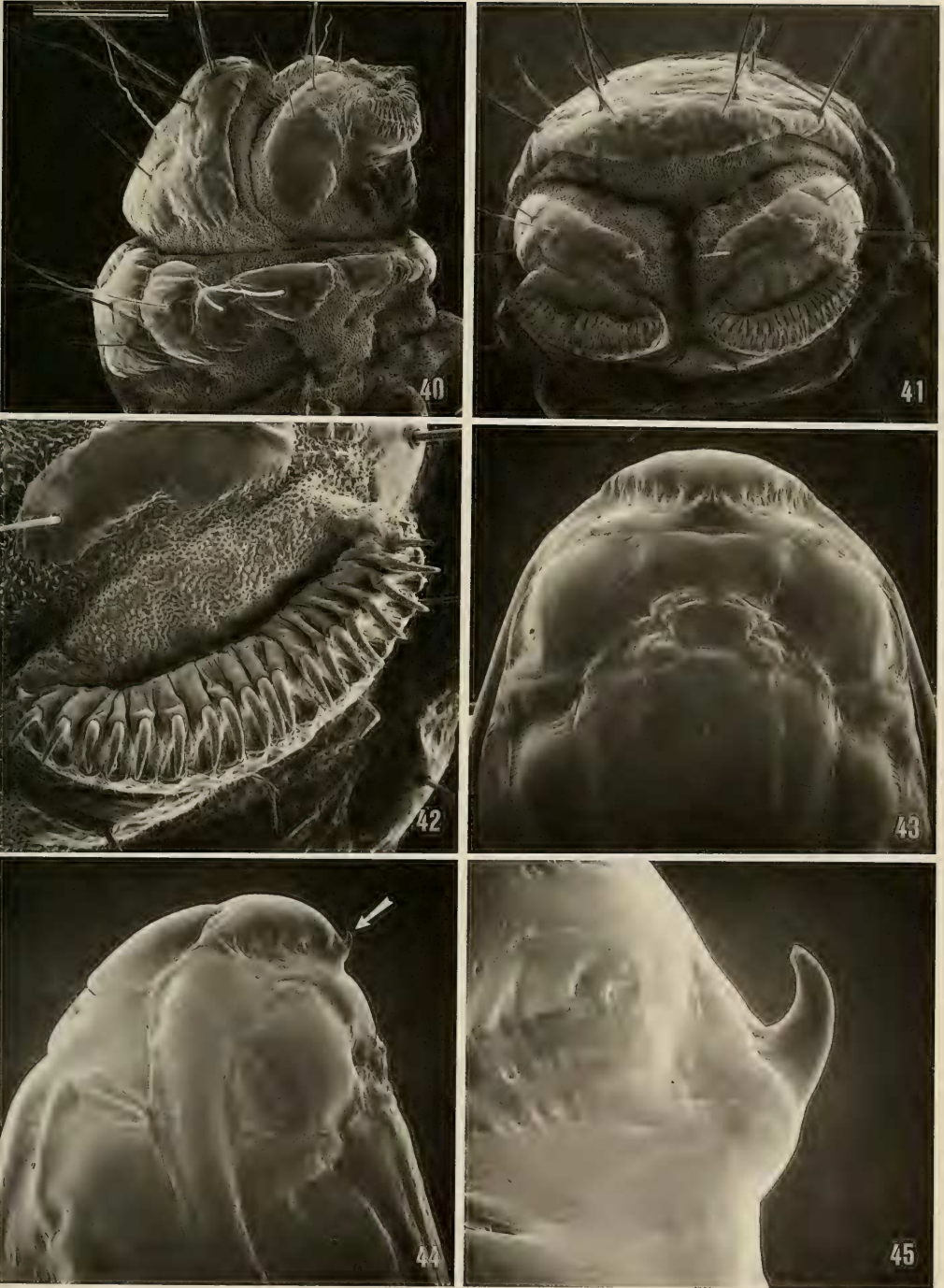
Etyymology.—The specific epithet is derived from the Latin *falcatus* (sickled-shaped, hooked) in reference to the falcate-tipped forewings.

Discussion.—Zenner-Polanía (personal correspondence 19 June 1989) reports that larvae of *P. falcata* feed within the stems of *Solanum quitoensis*, generally in groups of 3 to 5. Sometimes they co-occur with larvae of the stem-boring weevil, *Faustinus apicalis*, apparently scavenging in the detritus left by the latter. In freshly damaged stems, however, *Prosetomorpha* larvae appear to consume living plant tissue, thus resembling the broader feeding habit of a few *Opogona* (Davis and Peña 1990). Infested stems are typically swollen (Figs. 46, 47). Damage has been observed only in plants 10 months or older. After that period, even mature plants with stem diameters up to 10 cm are tunneled.

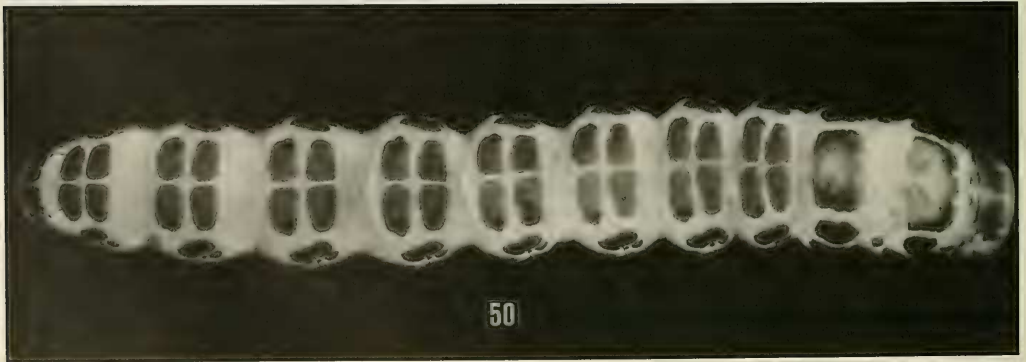
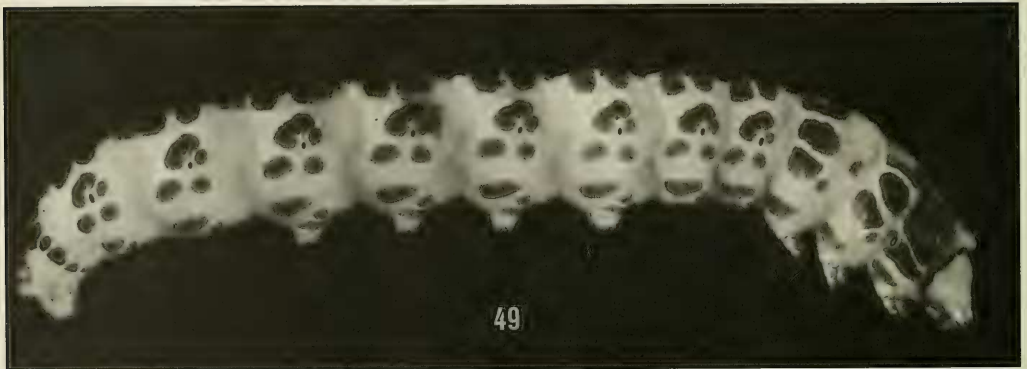
Older larvae are often found exposed within the galleries, with younger larvae most frequently occurring within flimsy, silken cases covered with frass. In the field,



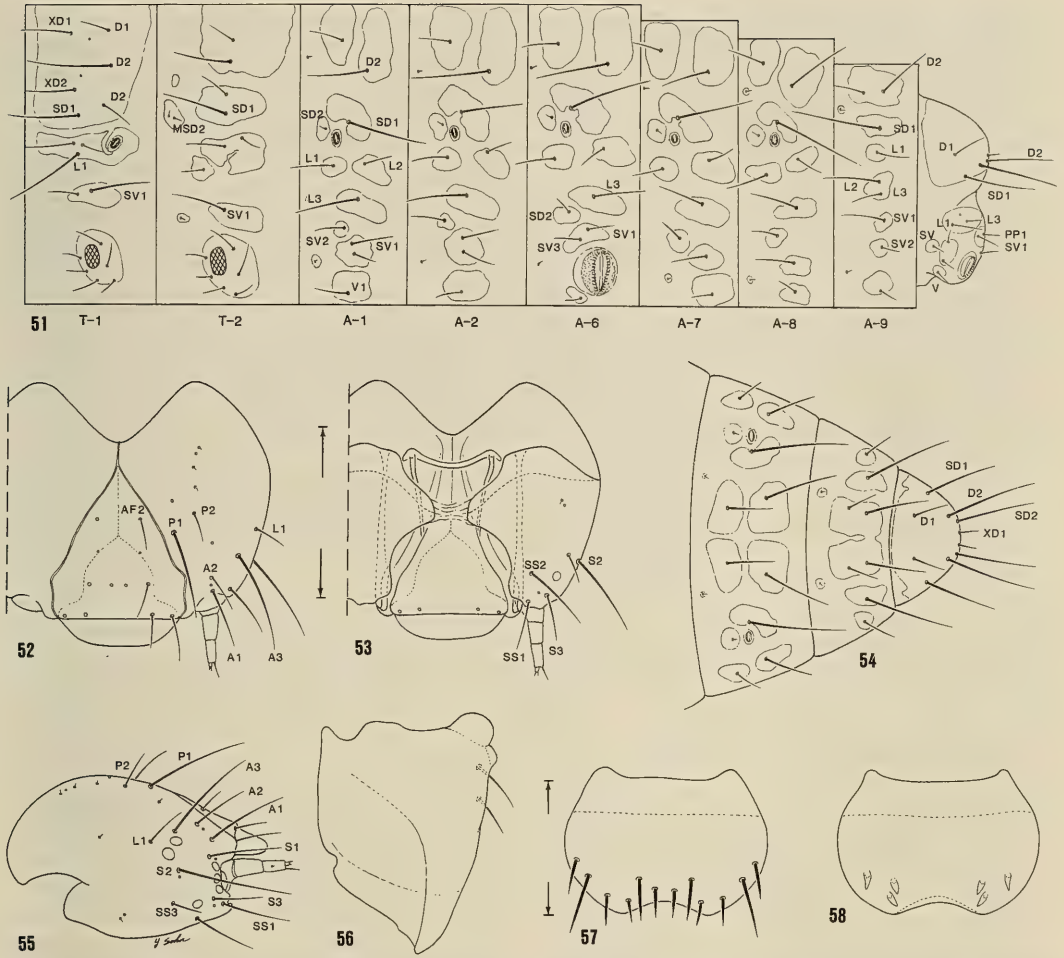
Figs. 34–39. *Prosetomorpha falcata*, last instar larva. 34, Head, lateral view (0.46 mm). 35, Detail of stemmatal area in Fig. 34 (150  $\mu$ m). 36, Maxilla (43  $\mu$ m). 37, Detail of sensilla at apex of maxillary palpus (8.6  $\mu$ m). 38, Pretarsus of metathoracic leg (43  $\mu$ m). 39, Right proleg, A4 (arrow = anterior; 158  $\mu$ m). (Scale lengths in parentheses; bar scale for all photographs = Fig. 34.)



Figs. 40–45. *Prosetomorpha falcata*. 40–42, last instar larva: 40, Lateral view of A9–10 (0.5 mm). 41, Caudal view of A10 (0.43 mm). 42, Right proleg of A10 (150  $\mu$ m). 43–45, Pupa: 43, Head, ventral view (0.6 mm). 44, Lateral view of Fig. 43 (0.6 mm). 45, Detail of frontal spine (with broken tip) in Fig. 44 (see arrow; 75  $\mu$ m). (Scale lengths in parentheses; bar scale for all photographs = Fig. 40.)



Figs. 46–50. *Prosetomorpha falcata*. 46, *Solanum quitoensis* damaged by stem-boring larvae of weevil, *Faustina apicalis*, and tineid, *Prosetomorpha falcata*. Arrow points to infested site indicated by swollen stem. 47, Closeup of swollen stem with protruding frass of *Prosetomorpha* (arrows). 48, Cocoon (23 mm). 49, Last instar larva, lateral view (20 mm). 50, Dorsal view. (Specimen lengths in parentheses.)



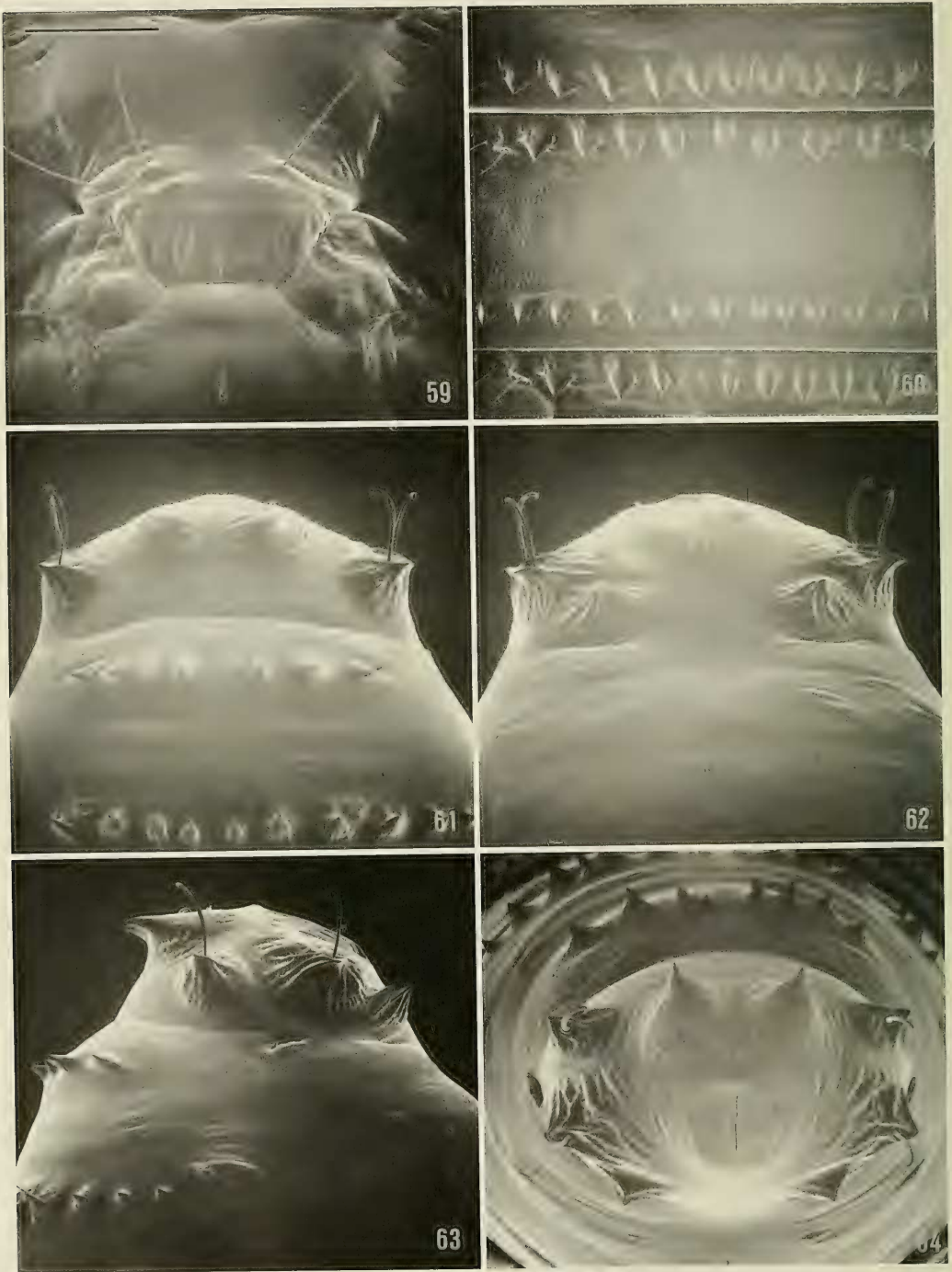
Figs. 51–58. *Prosetomorpha falcata*, morphology of last instar larva. 51, Chaetotaxy of pro- and mesothorax, abdominal segments 1, 2, 6–10. 52, Head, dorsal view (0.5 mm). 53, Ventral view. 54, Abdominal segments 8–10, dorsal view. 55, Head, lateral view. 56, Mandible (0.3 mm). 57, Labrum, dorsal view. 58, ventral view (0.3 mm). (Specimen lengths in parentheses.)

plant damage can be detected by the extrusion of silk-entwined frass from a “cleaning hole” in the stem (Fig. 47). This hole is never used as an exit by the moth; instead, the last instar larva chews another hole and pupates within a dark silken, frass covered cocoon, measuring up to 23 mm long and 6 mm in diameter (Fig. 48), that is formed inside the stem near the future exit hole. Following adult emergence, the pupal exuvium can be found protruding from this hole.

Because the larvae tend to be gregarious,

their concentrated feeding often weakens the stems sufficiently to facilitate breakage on windy days. In this manner, the larval feeding of *P. falcata* can be instrumental in the death of damage stems and, at times, even the entire plant.

The full complement of six pairs of stemmata easily distinguishes larvae of *P. falcata* from that of *Setomorpha* and *Lindera* (both without stemmata). The chaetotaxy of all three genera is very similar, including the shared presence of five pairs of setae on the anal plate (Fig. 54). *Prosetomorpha* dif-



Figs. 59–64. *Prosetomorpha falcata*, pupa. 59, Frontal region of head, ventral view (250  $\mu$ m). 60, Double rows of dorsal spines on abdominal segment 5 and portions of A4 and 6 (0.3 mm). 61, Dorsal view of A9–10 (0.38 mm). 62, Ventral view of A9–10 (0.38 mm). 63, Lateral view of A9–10 (0.38 mm). 64, Caudal view of A10. (Scale lengths in parentheses; bar scale for all photographs = Fig. 59.)

fers in having lost the first adfrontal seta and in possessing an additional seta (PP1) on A10 (Fig. 51).

#### ACKNOWLEDGMENTS

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